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ABSTRACT

To compare the effectiveness of individualized and lecture-discussion methods with a non-instruction (Control) method in developing turfgrass competencies in 11th and 12th grade students as measured by achievement in a battery of tests, teachers from 29 Michigan schools were randomly placed in three groups and attended workshops where they were provided with manuals, accompanying slides, audio-visual and curriculum materials, and an explanation of the study procedures. Five antecedent variable pretests were administered to the 632 students, and at the conclusion of the project, a battery of seven posttests was completed. Results revealed that the mean posttest scores were higher for students taught by the two instructional methods than the control group, and the mean posttest scores of students receiving individualized instruction were significantly higher than those receiving the lecture-discussion method after removing the variance attributed to each of the antecedent variables. However, when the posttest scores were analyzed as a composite package, there were no significant differences between the two instructional methods. The individualized method was also significantly more successful in developing student ability to locate and interpret information contained in turfgrass references. (SB)

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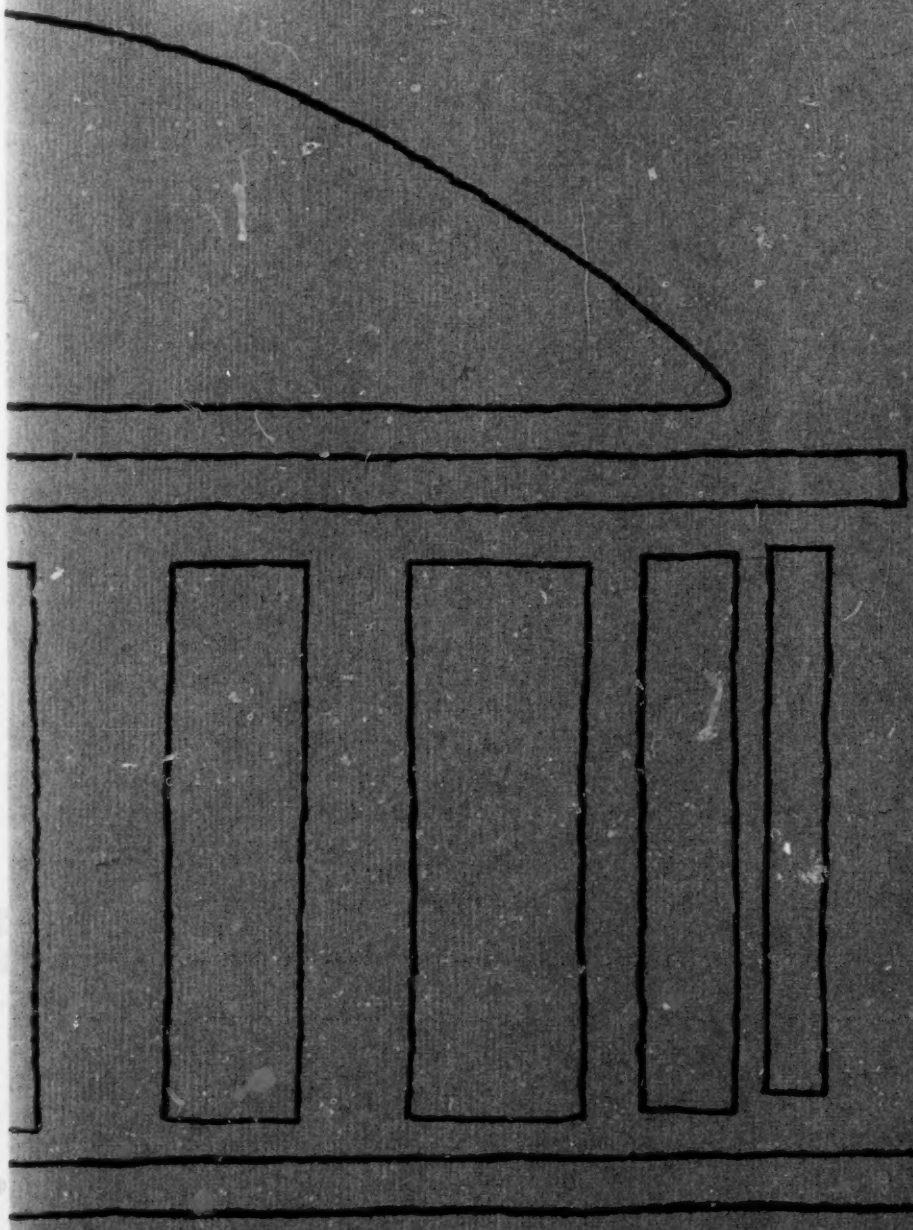

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Professional Series in Agricultural Education

Number 1

A Research Report
of a
Graduate Study

THE EFFECTIVENESS OF AN INDIVIDUALIZED LEARNING METHOD OF INSTRUCTION WHEN COMPARED TO THE LECTURE-DISCUSSION METHOD

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FOREWORD

This publication is a digest of a doctoral dissertation* conducted by Urban T. Oen pertaining to the relative effectiveness of individualized instruction when compared to the regular classroom group instruction methods. A control group was used for analysis of data.

In the dissertation the latest statistical methods of analyzing data were employed. A manual was developed for students to guide their learning activities. This manual was patterned after ones that had been developed in the department by Dr. Raymond Clark in cooperation with a group of selected Michigan teachers. The practices which were found to be desirable in those studies were used by Dr. Oen and in in-service education by staff members. It is felt that the findings of this study in this report can be used by teachers in increasing the understandings of individualized instruction.

This dissertation is the first of a series which will present a popularized version to provide professional workers and teachers a quick overview of the findings of this study. It is not intended to provide all of the procedures used in conducting the study nor the care that was followed in developing the manual and instructing teachers in utilizing individualized instruction. These may be obtained, if desired, from the microfilm of the dissertation.

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* Oen, Urban T. An Experimental Study Designed to Evaluate the Effectiveness of an Individualized Learning Method of Instruction When Compared to the General Lecture Discussion Method of Instruction. Ph.D. dissertation 1970 Michigan State University, pp. 214.

TABLE OF CONTENTS

	Page
Foreword	i
INTRODUCTION	1
Purposes of the study	4
The problem	4
Objectives	4
A review of literature on individualized instruction and learning	5
Method of investigation	7
ANALYSIS OF THE DATA	9
Mean post-test scores of students	9
Antecedent variable mean scores	10
Correlation between antecedent and dependent variables	11
MAJOR FINDINGS	15
Instruction versus no instruction	16
Individualized instruction method versus lecture-discussion method	16
Comparison of the different methods of instruction in developing in students the ability to locate and interpret information	18
Significant correlations between scores of antecedent variables and post-test scores	18
TEACHER REACTION TO RESEARCH STUDY	20
CONCLUSIONS	22
RECOMMENDATIONS AND IMPLICATIONS	25
APPENDIX A	
Overview of the analyses performed	29
Averaged effects of individualized and lecture-discussion methods versus the non-instruction (control) method	29
Individualized instruction versus lecture-discussion	30
Comparison of the different methods of instruction in developing in students the ability to locate and interpret information	33
Correlation between the antecedent variables and the dependent variable	33
SELECTED BIBLIOGRAPHY	35

THE EFFECTIVENESS OF AN INDIVIDUALIZED LEARNING METHOD OF INSTRUCTION WHEN COMPARED TO A LECTURE-DISCUSSION METHOD.

INTRODUCTION

Traditionally the high school vocational agriculture instructor has developed an instructional program based upon the occupational demands of the local community which, to some extent, fulfilled the needs of most of the students enrolled in high school vocational agriculture classes. With a declining number of students entering farming and still a number of youth desiring to go into some agricultural work, the vocational agriculture curriculum in many communities failed to provide preparation for both farm and off-farm occupations.

The Vocational Education Act of 1963[1] and the 1968 Amendments[2] set new goals for agricultural education and mandated that the curriculum of vocational agriculture be broadened to include training for off-farm occupations. The expansion of the agriculture curriculum and the development of new programs for off-farm agricultural occupations have created an exigency for new instructional materials.

To compound the problem, today's students enrolled in vocational agriculture classes have a variety of backgrounds and hold differing vocational education and occupational objectives. The teaching approach and the learning materials must be adapted to meet the needs of these heterogeneous students in a single classroom.

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[1] U.S. Congress, An Act, Public Law 88-210, 88th Congress, H.R. 4955, December 18, 1963.

[2] U.S. Congress, An Act, Public Law 90-576, 90th Congress, H.R. 18366, October 16, 1968.

Obviously, one cannot organize specialized classes to meet the vocational education or occupational objectives for each group of students who might enroll in vocational agriculture. The number of classes required would far exceed the supply of teachers available and class enrollment would become very small. In addition, the practicality of providing instruction in specialized classes with small enrollments could not be justified. Nevertheless, ways should be devised to meet the needs of students with different objectives while they are enrolled in the same classes. One approach to accomplish this goal is through individualized instruction in classes where needs of students differ significantly.

The concept of individualized instruction is not new. When parents serve as informal teachers, they often provide individualized instruction. Many teachers of vocational agriculture have been using some form of individualized instruction in their classrooms and in supervised occupational activities for years. Good teachers have tried to provide for individual students' needs and interests. However, this approach necessitates the availability of instructional resources so students can study appropriate content alone or in small groups in areas of common interest. It would be too much to expect the high school teacher to develop separate manuals and audiovisual materials for all the different occupational areas in the agricultural industry. Therefore, development of such materials rests with others, such as agricultural authors, state supervisory staff, and curriculum personnel in agricultural education.

In an attempt to help teachers provide instruction to students with

differing occupational objectives, Clark[3] developed a unique approach. Rather than provide completely structured units of subject matter, which soon become outdated; introductory textual material, followed by many suggested student activities, are provided. Students study appropriate resource materials and complete units of instruction to prepare them for job entry in some agri-industry. For this study, an individualized student learning manual on turf sales and service utilizing the same organizational pattern as Clark[4] was developed and evaluated.

The development of the units for the turf sales and service manual are attempts to help meet the need for learning materials for students with varying occupational objectives. The development of new materials does not necessarily guarantee their effectiveness in preparing students in the subject area. The question advanced by many high school teachers is, "How well do students learn from individualized learning situations when compared to traditional instruction?" Other questions are: 1, "Can all of our students learn by individualized instruction?", 2. "How effective is individualized instruction in preparing students for an occupation?", and 3 "Is there a difference in what can be learned by students using the individualized instruction method when compared to students taught by the traditional lecture-discussion method of instruction? For example, can students through individualized instruction solve problems and identify actual specimens as well as those students taught in a lecture-discussion class?"

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3 Instructional Units for Use in High School Programs in Agricultural Business was the title of the project directed by Dr. Raymond Clark during 1968-69 (East Lansing: College of Education, Michigan State University).

4 Ibid.

Purposes of the Study

The purposes of this study are:

1. To test the effectiveness of an individualized learning manual in developing in junior and senior vocational agriculture students the competencies necessary for initial employment in the turfgrass industry.
2. To compare the effectiveness of the individualized learning method of instruction with the general lecture-discussion method of instruction.
3. To identify the extent of relationship that reading comprehension, interest in turfgrass work, attitude toward individualized instruction, personality, previous knowledge, and previous work experience have on learning and developing the turfgrass competencies.
4. To identify the strengths and weaknesses of the individualized learning manual and the research study.

The Problem

Will the use of an individualized learning manual and audiovisual and curriculum materials on turfgrass sales and service develop in high school junior and senior vocational agriculture students the competencies deemed necessary for a beginning job in a turfgrass business as well as a general lecture-discussion method of instruction as determined by a battery of comprehensive post-tests?

Objectives

1. To compare (the averaged effects of the) individualized and lecture-discussion methods of instruction with the non-instruction

(control) method in developing turfgrass competencies in students as measured by student achievement on the seven comprehensive post-tests.

2. To compare the effectiveness of the individualized learning method of instruction with a general lecture-discussion method of instruction in developing turfgrass competencies in students as measured by student achievement on the seven comprehensive post-tests.
3. To identify the extent to which reading comprehension, attitude toward individualized instruction, interest in turfgrass work, prior knowledge, one's personality, hours devoted to turfgrass study, and the instructor's prior teaching experience and prior turfgrass experience are related to student learning.
4. To compare the effectiveness of the different methods of instruction in developing in students the ability to locate and interpret information in turfgrass references.
5. To obtain teacher opinions as to the strengths and weaknesses of the individualized learning manual and the research study.

A review of literature on individualized instruction and learning

A comprehensive review of current literature was completed in both agricultural education and general education. From the review of literature, it appears that:

- Teachers can be effective with individualized instruction techniques if they :

  ... are introduced to the mechanics of using the new instructional materials

... know what new concepts and principles are to be developed in students by use of the new materials

... understand their role with this method of instruction

... use a wide variety of motivational techniques

... are provided time to work with the students individually

- Individualized instructional units are an effective means of teaching if:

  ... they are self-instructional

  ... the lessons contain terminal behavioral objectives

  ... different learning materials are available to accommodate different learning techniques

  ... adequate materials and facilities are made available

  ... content relies on reality and actual experiences

  ... they involve the interaction of persons, procedures and materials

- Individualization of instruction is effective if the students:

  ... are properly oriented and acclimated to this type of instruction

  ... are actively involved

  ... can set their own goals

  ... can proceed at their own pace

  ... can evaluate their own progress

  ... are interested in the subject and if the subject meets the students' needs and is geared to their abilities

- When researching individualized instruction programs, the following factors should be considered:

  ... pupil aptitude

  ... achievement

  ... interest

... learning techniques

... classroom performance

Method of Investigation

An individualized learning manual on turfgrass sales and service was developed and pre-tested with vocational agriculture students in three high schools in Michigan. The students and teachers evaluated the manual at the end of the pre-test. A revised manual containing ten lessons was developed and used in this study.

Teachers of vocational agriculture of central Michigan volunteered to participate in the study. Those volunteering were placed into three groups by a table of random numbers. Group one used the individualized instruction method, group two the lecture-discussion method, and group three the non-instruction (control) method.

Workshops for the teachers were conducted by the author. Teachers of the individualized and lecture-discussion methods of instruction were provided with manuals and accompanying slides, audiovisual and curriculum materials and an explanation of the procedures for the study.

Five antecedent variable tests were administered to the 632 students involved in one of the three methods before instruction began. At the conclusion of the project, a battery of post-tests were completed by all of the students participating in the study. In addition, the teachers completed a survey in which they evaluated the manual and the project.

The tests were machine scored with the scores simultaneously punched onto IBM cards. The data were analyzed with the Finn program,

which is a univariate and multivariate analysis of variance and covariance using univariate statistics, and a 13 x 13 intercorrelation matrix. Comprising the matrix were seven post-tests and six antecedent variables. Of the antecedent variables four were test scores and two were teacher variables.

In addition, a calculation of least squares (regression) and multiple correlation was run to determine the correlation, (if any), between the students' scores on the antecedent variable tests and the scores on the post-tests. (A more detailed description of the analysis can be seen in the dissertation.)

ANALYSIS OF THE DATA

The analysis of the student data is presented in this section of the report in the same order of presentation in the section dealing with the objectives. An evaluation of the manual, research project, and project procedure by the teachers was included in the dissertation but was omitted from this section of the report.

The units of analyses for hypotheses one, two, and three were based on school means while the units of analyses for hypothesis four were individual student scores. The units of analyses for the data contained in Tables 1, 2 and 3 were also based on school means.

Mean post-test scores of students

The means and the (pooled-within) standard deviations of the post-test scores of the vocational agriculture students of the two instructional methods and the non-instruction (control) method are contained in Table 1. A visual comparison of the mean post-test scores shows that on all seven post-tests,* the individualized instruction method ranked highest, the lecture-discussion method was second, and

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* Each post-test tested the students on different areas of competencies. The following is a list of competencies covered by each post-test. Post-test six contained actual specimens of immature weeds, turfgrass specimens, and turfgrass seeds while the others contained multiple choice, problems, matching, and short-answer questions.

Post-test	Areas of Competencies Covered
1	Career Opportunities, Salesmanship and Human Relations
2	Types and Characteristics of Turfgrasses
3	Turfgrass Establishment, Care, and Maintenance
4	Fertilization and Liming
5	Identification and Control of Weeds
6	Seed, Turfgrass and Weed Specimen Identification
7	Interpretation and Location of Information (open book test)

the non-instruction (control) method third. On post-tests two and four, the possible scores were small which resulted in very small (pooled-within) standard deviations and differences appeared to be smaller than on other tests. Post-test two covered types and characteristics of turfgrasses while test four covered fertilization and liming.

TABLE 1

MEANS AND STANDARD DEVIATIONS OF THE POST-TEST SCORES OF THE VOCATIONAL AGRICULTURE HIGH SCHOOL STUDENTS OF THE TWO INSTRUCTIONAL METHODS AND THE NON-INSTRUCTION (CONTROL) METHOD

Method of Instruction	Mean Post-test Scores: Post-test 1	2	3	4	5	6	7
Possible Score	31	9	21	8	14	19	11
Individualized (N = 9 schools)	16.77	3.47	12.83	3.89	5.20	8.56	5.57
Lecture-Discussion (N = 10 schools)	13.11	3.41	8.48	3.81	3.68	5.87	3.57
Non-Instruction (Control) (N = 10 schools)	9.01	1.66	3.65	2.67	1.63	1.06	3.27
Pooled Within Standard Deviation	2.80	.74	2.39	.62	1.19	1.88	1.27

Antecedent variable mean scores

The antecedent variables were determined and measured before instruction began. The mean scores and pooled-within standard deviation of the antededent variables of the high school vocational agriculture students and teachers of the two instructional methods and the non-instruction (control) method are shown in Table 2. There were only

small differences between the mean antecedent variable scores of the students of the three methods of instruction. Very little difference existed, too, between two teacher variables, the years of teaching experience and previous turfgrass experience. Small differences were expected since the groups were randomly equivalent at the outset.

Students, on the average, answered 34 per cent of the 90 items of the turfgrass pre-study analysis (turfgrass knowledge pre-test). They were uncertain of their interest in turfgrass work since the mean average of 35.7 fell in the uncertain range. A score of 22 would show total dislike, 44 would show uncertainty, and 66 would indicate complete interest in turfgrass work.

The students were also uncertain of their attitude toward individualized instruction as the mean attitude scores ranged from 50 to 52 points on a scale ranging from 20 points for strongly favoring to 100 points for strongly unfavorable. The uncertain range on the scale was between 50 and 70 points.

The mean scores of students on the Cooperative English Test had the greatest variance and largest (pooled-within) standard deviation. Thus, students from the different schools were shown to be unequal in comprehension and verbal ability.

Correlation between antecedent and dependent variables

The correlations between the dependent and antecedent variables using school means as the unit of analysis are contained in Table 3. The overall general low correlations between the dependent and antecedent variables indicate that the antecedent variables are not

TABLE 2

ANTECEDENT VARIABLE MEAN SCORES AND STANDARD DEVIATIONS OF THE HIGH SCHOOL VOCATIONAL AGRICULTURE STUDENTS AND TEACHERS OF THE TWO INSTRUCTIONAL METHODS AND THE NON-INSTRUCTION (CONTROL) METHOD

Method of Instruction	Antecedent Variable Mean Scores					
	Student Variables				Teacher Variables	
	Pre-Study Analysis	Interest	Attitude	Cooperative English	Teaching Experience	Turfgrass Experience
Individualized (N = 9 schools)	31.33	34.89	52.81	53.51	2.22	1.22
Lecture-Discussion (N = 10 schools)	30.14	36.72	52.76	54.55	2.70	1.10
Non-Instruction (Control) (N = 10 schools)	31.91	35.88	50.72	57.81	2.50	1.40
Pooled Within Standard Deviation	2.44	4.08	2.46	5.37	1.11	.43

good predictors of post-test scores. The correlations do reveal some interesting relationships; for instance, there were negative correlations between teaching experience and post-test one (-.442) and post-test two (-.372). Post-test one covered career opportunities and salesmanship and human relations while post-test two covered types and characteristics of turfgrasses. An inverse relationship shows that students of those teachers with more teaching experience tended to do poorer on post-tests one and two than did students of teachers with less teaching experience.

Post-test seven, an open book test covering location and interpretation of turfgrass information, was postively correlated (.366) with the Cooperative English Test and negatively correlated (-.378) with turfgrass experience. This indicates that students with high reading comprehension and verbal ability tended to score high on post-test seven. The negative correlation between post-test seven and turfgrass experience indicates that students of teachers who had previously taught turfgrass tended to score higher on post-test seven than did students of teachers who had not previously taught turfgrass.

TABLE 3

CORRELATION MATRIX (WITHIN CELLS) BETWEEN THE ANTECEDENT AND DEPENDENT VARIABLES

Variable	Post-test 1	2	3	4	5	6	7	Pre-study Analysis	Interest	Attitude	Cooperative English	Teaching Experience	Turfgrass Experience
Dependent variables													
Post-test 1	1.000												
Post-test 2	0.559	1.000											
Post-test 3	0.708	0.503	1.000										
Post-test 4	0.385	0.580	0.269	1.000									
Post-test 5	0.583	0.585	0.515	0.558	1.000								
Post-test 6	0.369	0.503	0.496	0.375	0.470	1.000							
Post-test 7	0.543	0.528	0.514	0.215	0.568	0.523	1.000						
Antecedent variables													
Pre-study analysis	0.041	0.175	0.159	0.020	0.073	0.154	0.492	1.000					
Interest	0.292	0.014	0.153	0.292	0.392	-0.124	-0.027	-0.048	1.000				
Attitude	-0.259	0.251	-0.008	0.205	-0.021	0.295	-0.043	-0.099	-0.152	1.000			
Cooperative English	0.245	0.133	0.140	-0.272	-0.108	-0.011	0.366	0.437	-0.057	-0.286	1.000		
Teaching Experience	-0.442	-0.372	-0.174	-0.156	-0.050	0.041	-0.177	0.262	-0.063	-0.006	-0.035	1.000	
Turfgrass Experience	-0.152	-0.059	-0.158	0.263	-0.202	-0.148	-0.378	-0.195	0.074	0.372	-0.325	-0.252	1.000

MAJOR FINDINGS

The major findings of the study are reported in this section of the report under two headings: (1) those related to the students and (2) those related to the teachers. For a complete listing of all findings, the reader is referred to the original study. An overview of the statistical analyses on which these findings are based is contained in Appendix A. An explanation of the statistical analyses performed will help the reader understand the findings. A comparison was made between the averaged mean post-test scores of students taught by either individualized or lecture-discussion instruction with scores of the non-instruction (control) students to determine if the post-test scores earned by the students with organized instruction were a result of instruction or whether they occurred by chance. It was concluded that the differences in the scores (See Table 1, p. 10) were a result of instruction. Later, a similar comparison between the post-test scores of students of the individualized and lecture-discussion methods of instruction was made. The students of the individualized instruction method scored significantly higher when one analysis was made: however, the difference was not significant when a different analysis was used. Individual statistical analyses were also performed for each post-test. Students of the individualized instruction method scored significantly higher than the students of the lecture-discussion method of instruction on five of the seven post-tests. In light of this information, the following significant findings are presented.

Instruction versus no instruction

- The mean scores (post-test) for the students when taught by one of the two instructional methods were higher than those students who did not have instruction (control groups) and the difference was considered to be due to instruction and not to chance. The difference between the averaged mean post-test scores of students of the individualized and lecture-discussion methods of instruction and the non-instruction (control) method was measured by univariate and multivariate analyses of variance and covariance. The difference in mean scores was significant at the .01 level for both the analyses of variance and for the analyses of covariance.

Individualized Instruction Method
Versus Lecture-Discussion Method

- The mean post-test scores of students using individualized instruction method were significantly higher (at the .05 level) than those of students having the lecture-discussion method of instruction after removing the variance attributed to each of the antecedent variables. The mean post-test scores of students with either the individualized or lecture-discussion methods of instruction were measured by univariate and multivariate analyses of variance and multivariate analyses of covariance with each of the six antecedent variables considered individually. The level of significance (.0157) for the analysis of variance and (.029) for each of the analyses of covariance was found.

- No significant difference between the mean post-test scores of students using the individualized and the lecture-discussion methods of instruction was found when measured by univariate and multivariate analyses of covariance with six covariables and analyzed (controlled) in one computational process. Even though there was no significant difference when the post-test scores were analyzed as a composite package, there were significant differences between the univariate F values when measured by one-way analyses of variance for post-test one, three, five, six, and seven. Students using the individualized instruction method scored significantly higher on the following post-tests for the following subject areas:

  1 Career opportunities and salesmanship and human relations;

  3 Turfgrass establishment, care, and maintenance;

  5 Identification and control of weeds;

  6 Seed, turfgrass, and weed specimen identification; and

  7 Interpretation and location of information in turfgrass references.

- No significant differences between the post-test scores for the two groups of students using different instructional methods were found for the following subject areas:

  2 Types and characteristics of turfgrasses; and

  4 Fertilization and liming of turfgrasses.

Comparison of the different methods of instruction in developing in students the ability to locate and interpret information

- The individualized method of instruction was significantly better (significant at the .05 level for analyses of variance and covariance) than the lecture-discussion method of instruction in developing in students the ability to locate and interpret information contained in turfgrass references as measured by student scores on post-test seven.

- Both the individualized and lecture-discussion methods of instruction when averaged together were significantly (.05 level) better than the non-instruction (control) method in developing in students the ability to locate and interpret information contained in turfgrass references on post-test seven.

Significant correlations between scores of antecedent variables and post-test scores

- The correlation between the antecedent and dependent variables indicated that post-test scores can be predicted from the antecedent variable scores.

- Only one antecedent variable, the pre-study analysis, was positively correlated to post-test scores of students using the individualized and lecture-discussion methods of instruction. It was also positively correlated with post-test scores of students having lecture-discussion teaching.

- Scores of neuroticism and lie-scales included in the Eysenck Personality Inventory were negatively correlated to the post-test scores of students using the individualized instruction method and with the post-test scores of students taught by the lecture-discussion method.

- The correlation between the above three antecedent variables and post-test scores was .51 but accounted for only 2.6 per cent of the variation found in the dependent variable for the students using individualized instruction. The correlation was .46 accounting for 21 per cent of the variation in the post-test scores of students having the lecture-discussion method.

- Similar correlations were found when the scores of the students utilizing either instructional method were combined.

- The scores of antecedent variables, Cooperative English and attitude toward turfgrass were negatively correlated with post-test scores of the two groups of students.

- The post-test scores of students in the control group and their scores on the Cooperative English Test were positively correlated while the post-test scores were negatively correlated to their attitude toward individualized instruction.

TEACHER REACTION TO THE RESEARCH STUDY

- The teachers using the individualized instruction method "strongly agreed" that: (1) upon completion of each lesson, the student should complete a teacher administered quiz which would be graded by the teacher to determine the level of competency developed and to indicate if a student were really ready to advance; (2) the audiovisual materials were helpful and added to understanding of the manual; (3) students require teacher motivation in order to study the manual; (4) the instructor contributes to the success of failure of the particular manual being used by the students; and (5) poor readers do not perform well in using the individualized learning manual. The teachers using the lecture-discussion method also "strongly agreed" with items two and four and "agreed" with items one, three, and five.

- Teachers using either instructional method agreed that: (1) instructors should be very familiar with the units before study begins; (2) the manual and reference materials seemed complete and accurate; (3) the learning activities were very appropriate in developing understandings, knowledges, and skills needed by beginning employees in turfgrass sales and service; (4) the turfgrass unit can be used by students wishing to study turfgrass individually; (5) the text, lessons, and the introductory sections were very appropriate; (6) the lesson behavioral objectives seemed complete and accurate; (7) the manual should

be studied by interested students throughout the year and on a seasonal nature but not by an entire class; (8) the present study conducted was too large or encompassing; and (9) the post-tests were comprehensive and adequate.

- Teachers using the individualized instruction method agreed that students felt lost without standards with which to compare themselves, while teachers of the lecture-discussion method rated their judgment as being "uncertain."

- When the lecture-discussion method of instruction was used teachers agreed that:

  . the self-evaluation questions were adequate in determining whether the students had mastered the subject

  . the type of pre-tests (antecedent variable tests) were adequate

  . there were too many pre-tests but when individualized learning was directed, the teachers were uncertain as to adequacy of the tests

  Both groups of teachers were uncertain as to whether teacher-administered quizzes should be administered weekly.

- Teachers using either instructional method did not agree that most high school students are capable of discipling themselves to study on an individualized basis.

CONCLUSIONS

The following conclusions were drawn from analyses of student data:

- The non-structured individualized learning manual was effective in learning turfgrass knowledges and skills to high school vocational agriculture students in Michigan. The mean post-test scores of students enrolled in lecture-discussion classes were significantly lower than those enrolled in individualized learning in two of the six subject areas, "Types and Characteristics of Turfgrasses" and "Fertilization and Liming," there was no significant difference. A plausible explanation of this is that many vocational agriculture teachers in Michigan normally teach such units in Crop Science courses.

- Students enrolled in classes using one of the two instructional methods scored significantly higher than the non-instruction (control) group. This was interpreted as proof that learning did result in groups with instruction.

- Since the individualized method of instruction was significantly more successful than the lecture-discussion method of instruction in developing in students the ability to locate and interpret information contained in turfgrass references, it can be concluded that such reading skills can be taught effectively when using individualized learning techniques.

- Post-test scores can be predicted from the antecedent variable scores.

  - The scores on pre-study analysis and the Neuroticism and Lie Scales of the Eysenck Personality Inventory were the best predictors of the post-test scores of students of the individualized instruction method.

  - The scores of pre-study analysis were almost equally valuable as a predictor of post-test scores of students of the lecture-discussion method.

  - The scores in pre-study analysis, hours of study, and negative influence of the Neuroticism and Lie Scales of the Eysenck Personality Inventory combined to make best predictions of post-test scores of students using the two instructional methods.

  - The scores of Cooperative English and attitude tests were the best predictors of the post-test scores of students of the non-instruction (control) method.

  - The scores of interest test and the Extraversion Scale of the Eysenck Personality Inventory were not good predictors of post-test scores of the students of the three methods of instruction.

The following conclusions were drawn from teacher reactions; in their opinion:

- The individualized learning manual and accompanying reference materials were complete and accurate.

- The format and content of the manual, i.e., introduction, text, lessons, terminal behavioral objectives, learning activities and self-evaluation questions were appropriate to the development of understandings, knowledges, and skills needed for successful work in the turfgrass industry.

- The audiovisual and curriculum materials were helpful and added to understanding of the manual.

- The manual should be studied only by interested students on a seasonal nature throughout the year and not completed all at one time.
- Instructors need to be very familiar with the subject areas of the individualized learning manuals before actual instruction begins.
- Various types of motivation should be written into the manual as a substitute for teacher motivation in a teacher-directed situation.
- The manual probably should be rewritten to lower the reading level. Students with low reading comprehension and low verbal ability tended to score lower. Even the tests may have been written at too high a reading level.
- Upon completion of each lesson, the student should complete an objective examination or tape an oral report which could be graded. This was recommended as the teachers were uncertain whether the self-evaluation questions were adequate in determining whether the students had mastered the subject.
- Standards with which to compare themselves should be provided for students and appropriate awards given.
- Most high school vocational agriculture students must be trained to study independently since it is a new experience for many who have only had group instruction.
- The research project conducted was too complex for most teachers of vocational agriculture.

RECOMMENDATIONS AND IMPLICATIONS

The implications of this study for teaching and learning when considered in the light of other studies which are summarized on page 6 may become far reaching in terms of the development of learning materials and directing independent study in vocational agriculture classes.

- o More instruction in vocational education can be individualized and geared to the needs and interests of the students. However, since poor readers need more help, more audiovisual materials and more learning-by-doing activities to help them succeed, resource materials must be written for the reading abilities of most students since the teacher does not have the time to work with these students on an individual basis.

- o The state staff and university personnel in agricultural education should encourage the development of instructional materials and additional individualized learning manuals in other areas of agriculture. Effort should be made to vary the reading level in the materials with attention given to both high verbal ability and low verbal ability students.

- o Adequate and appropriate audiovisual and curriculum materials need to be developed and/or obtained for each individualized learning manual developed.

- o Teacher educators should provide appropriate experiences for prospective vocational agriculture teachers in the appropriate

use of individualized instruction materials. This could be accomplished by: (A) placing student teachers in centers where the supervising teachers employ individualized instruction techniques; and/or (B) develop in a methods class opportunities for students to experience individualized instruction.

- The state staff and university personnel in agricultural education should provide appropriate in-service meetings or workshops on the use of individualized learning manuals and on techniques of individualized instruction to insure successful teaching by this method. Some of the findings in this study should be covered in the workshop or meeting:

  ... Only interested students should be taught by the individualized learning manuals.

  ... Instructors need to be very familiar with the subject areas and the types of recommended learning situations found in the individualized learning manuals before actual study begins.

  ... The instructor should teach the student how to use a particular manual and make frequent checks of student activity when first introduced to insure realistic progress.

  ... Students need to be motivated by the teacher in order to study the individualized learning manual.

  ... Poor readers may not perform well with the present individualized learning manual when the reading level is high. Poor readers need more teaching, more audiovisual materials, more learning-by-doing activities to help them succeed.

  ... Many students need standards for self-evaluation. Standards and other student evaluations are needed. Teachers' quizzes, student reports, and other such measures should be employed at the completion of each lesson. The feedback from the teacher on these activities is considered essential in order to reinforce the student.

> ... Many high school students are not capable of disciplining themselves to study on an individualized basis. During the beginning of individualized study teachers should offer day to day guides to help the students establish standards and pace their study.

- In future research projects, the number of pre-tests and post-tests should be kept to a minimum. A knowledge pre-test and a test of the student's ability, such as the Cooperative English Test, are probably adequate. In addition, the length of study should be either six weeks or less, or if longer, broken down in segments and studied seasonally if appropriate.

APPENDIX

A P P E N D I X A

STATISTICAL ANALYSES USED IN THIS STUDY

Overview of the analyses performed

The purpose of this overview is to provide the reader with a synopsis of the different analyses performed and the significance of the analyses in the hope of facilitating reader understanding. A summary of the analyses performed for the four hypotheses is contained in Table 4. (For a more detailed analysis, the reader is referred to the dissertation.)

Averaged effects of individualized and lecture-discussion methods versus the non-instruction (control) method

Null hypothesis number one was: There will be no difference in student achievement on the seven comprehensive post-tests between the averaged effects of the individualized and lecture-discussion methods of instruction and the non-instruction (control) method. To test for hypothesis one, the following analyses were performed: (1) univariate and multivariate analyses of variance; (2) multivariate analyses of covariance with each covariable considered individually; and (3) univariate and multivariate analyses of covariance with all six covariables controlled.

The univariate and multivariate analyses of variance generated an F value of 11.525 which was significant at the .0001 level. The multivariate analyses of covariance with the effects of each covariable considered individually resulted in F values all of which

were significant at the .0001 level.* The univariate and multivariate analyses of covariance with all six covariables controlled resulted in an F value of 4.52 which was significant at the .008 level. Therefore, null hypothesis number one was rejected as there was a significant difference between the two instructional methods and the non-instruction (control) method. The individualized and lecture-discussion methods of instruction were significantly better than the non-instruction (control) method. The data indicate that the higher scores obtained by the students of the two instructional methods were a result of instruction, not chance.

Individualized instruction versus lecture-discussion

Null hypothesis number two was: There will be no difference in student achievement on the seven comprehensive post-tests between the individualized learning method of instruction and the general lecture-discussion method of instruction. To test for hypothesis two, the following analyses were performed: (1) univariate and multivariate analyses of variance of the mean post-test scores; (2) multivariate analyses of covariance with each covariable considered individually; and (3) univariate and multivariate analyses of covariance with all six covariables controlled.

The univariate and multivariate analyses of variance of mean post-test scores of students of the individualized and lecture-discussion

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* Analyses of covariance are normally performed for refinement of the analyses; however, with a .0001 level of significance, nothing was gained by such an analysis.

methods of instruction resulted in an F value of 3.35 which was significant at the .0157 level. The mean post-test scores of students using the individualized instruction method were significantly higher than the mean post-test scores of students studying with the lecture-discussion method of instruction.

A multivariate analyses of covariance with each covariable considered individually with the post-test scores resulted in F values which were significant at the .05 level. There was still a significant difference between the post-test scores of students of the individualized and lecture-discussion methods of instruction after removing the variance attributed to each of the antecedent variables.

The univariate and multivariate analyses of covariance of the mean post-test scores with all six covariables controlled between students of the two instructional methods resulted in an F value of 2.65 which was not significant at the .05 level. Therefore, null hypothesis for number two was not rejected as there was no significant difference between the mean post-test scores of students of the two instructional methods. (There was a significant difference in five of the seven post-test univariate F values which was shown in Table 4.13 of the dissertation but is not shown in Table 4 of this report.)

There are two plausible explanations for the loss of significance on the final univariate and multivariate analyses of covariance with all six covariates controlled: (1) loss of degrees of freedom in the statistical model employed to analyze the data; and (2) chance differences that occurred in the antecedent variable scores. (Each of these possibilities was explained in detail in the dissertation.)

TABLE 4

SUMMARY TABLE OF ALL ANALYSES PERFORMED FOR THE FOUR HYPOTHESES

	HYPOTHESES							
	1			2		3	4
Method of Instruction	Averaged Effects of Individualized and Lecture-discussion vs. Non-instruction (Control)			Individualized Instruction vs. Lecture-Discussion		Averaged Effects of Individualized and Lecture-Discussion vs. Non-instruction Individualized vs. Lecture-discussion	All methods of instruction
Statistical method	Multivariate analyses of variance	Multivariate analyses of covariance Each antecedent variable analyzed individually	Multivariate analyses of covariance All six antecedents variables at one time	Multivariate analyses of variance	Multivariate analyses of covariance Each antecedent variable analyzed individually	Multivariate analyses of covariance with all six antecedent variables at one time	Analysis of variance & analysis of covariance between the mean scores of post-test 7	Multiple regression correlation between dependent & antecedent variables
F Ratio	11.525	Pre-study 10.211 Interest 11.134 Attitude 8.897 Coop. Eng. 9.466 Teach.Exp. 10.971 Turf Exp. 10.138	4.52	3.353	Pre-study 2.942 Interest 3.534 Attitude 3.340 Coop. Eng. 3.324 Teach. Exp 3.387 Turf Exp. 3.927	2.65	ANOVA - 11.75 ANOCO - 9.92	I - 4.73 L-D - 5.86 Com.10.33 C 7.37
P less than	.0001	Pre-study .0001 Interest .0001 Attitude .0001 Coop. Eng. .0001 Teach.Exp. .0001 Turf Exp. .0001	.008	.0157	Pre-study .0290 Interest .0134 Attitude .0172 Coop. Eng. .0175 Teach. Exp..0162 Turf exp. .0083	.0576	ANOVA - .0021 ANOCO - .0051	.0005

* I - Individualized; L-D - Lecture-Discussion; Com - Individualized & Lecture-Discussion; C - Control

ANOVA - Analysis of variance; ANOCO - Analysis of Covariance

Comparison of the different methods of instruction in developing in students the ability to locate and interpret information

Null hypothesis number three was: There will be no difference between the effectiveness of the different methods of instruction in developing in students the ability to locate and interpret information contained in turfgrass references. To test for hypothesis three, analyses of variance and covariance were performed on post-test seven which compared: (1) the averaged effects of individualized instruction and lecture-discussion with non-instruction (control); and (2) the individualized instruction method with the lecture-discussion method.

The F values of both the analyses of variance and covariance were significant at the .05 level; therefore, the hypothesis was rejected. Students of the two instructional methods were able to locate and interpret information better than students of the non-instruction (control) method while students of the individualized instruction method performed significantly better than students using the lecture-discussion method.

Correlation between the antecedent variables and the dependent variable

Null hypothesis number four was: There will be no correlation between the antecedent variables and the dependent variable (post-test scores) of students of the different methods of instruction. Multiple regression correlation analyses were performed between the antecedent variables and the dependent variables for students of each

method of instruction as well as for a combination of students of the two instructional methods. The high F values generated from the multiple regression analyses resulted in a significance of less than .0005 which indicates that the antecedent and dependent variables were correlated and that post-test scores can be predicted from the antecedent variable scores.

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